

2008 Annual Report on Air Emissions from Facilities at Campbell Industrial Park

Prepared by:
Clean Air Branch
Hawaii State Department of Health

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Introduction

This report has been prepared by the Clean Air Branch of the Department of Health pursuant to the requirements set forth in Hawaii Revised Statutes (HRS) §342B-18. The purpose of the report is to provide members of the communities surrounding Campbell Industrial Park and Kahe Valley with an understanding of the circumstances and activities related to ambient air quality in those areas.

HRS 342B-18 directs the Department of Health to generate an annual report to the communities using specific information provided by the major sources located in Campbell Industrial Park and Kahe Valley. The information for this report is based on the annual data collected in 2007.

For the sake of clarity, the report is divided into three sections. Section one addresses the activities of the major sources and is split into two distinct parts. The first part of section one describes each major facility, the sources of emissions, and the air pollution controls that the facility employs to minimize its air emissions. The second part, Table A, identifies the type and quantity of criteria air pollutant emitted by each major facility for the calendar year.

Section two provides the air quality monitoring data obtained from the three monitoring stations located on the outskirts of Campbell Industrial Park. The data are presented in tabular form as well as in graphs which compare the data to the federal and state ambient air quality standards. In every case, Hawaii's air quality is far better than the national, health-based standards. The graphs also help illustrate any trend over the last five years.

The final section is a report on the measurements of the criteria and non-criteria air pollutants and the expected health effects at the measured levels. The purpose of this section is to provide the reader with an understanding of the potential impacts on human health at the existing levels of air quality.

The Clean Air Branch of the Department of Health administers the statewide air pollution control program. It consists of a permitting program which regulates the facilities, an air quality and source monitoring program, and an investigatory and enforcement program.

If you have questions about this report or about air quality, please contact the Clean Air Branch at the following:

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A copy of this report can be found at the Clean Air Branch website:
<http://www.hawaii.gov/health/environmental/air/cab/index.html>
Click on the link, "2008 Annual Report on Campbell Industrial Park."

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SECTION 1.
Summary of Criteria Pollutants
Emitted by Major Source Facilities in
Campbell Industrial Park & Kahe Valley in 2007
and a Description of the Air Pollutant Controls

Criteria Pollutants Emitted by the Facilities

The criteria pollutant emissions from the major sources in Campbell Industrial Park (CIP) and Kahe Valley are listed in **Table A**. The emissions were derived using actual operating hours or fuel usage, stack test results, continuous emission monitoring data, and standard emission factors.

Descriptions of the Respective Criteria Pollutant Controls

AES Hawaii, Inc.

AES Hawaii, Inc. operates a coal-fired cogeneration plant which generates electricity for operation and sale to Hawaiian Electric Company. Coal is imported, crushed, then fed into two (2) circulating fluidized bed (CFB) boilers. Tire derived fuel (TDF), spec used oil, and spent activated carbon are used as secondary fuel. After combustion, the air emissions flow through a selective non-catalytic reduction system and baghouse before it reaches the exhaust stack. There is also a cooling tower which extracts heat from the combustion gases and emit particulates which are dissolved solids in the evaporated water.

Total suspended particulates (TSP), sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), and lead (Pb) are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. Fugitive TSP emissions are contained in enclosed structures during the transportation and processing of the coal. Baghouses also collect fugitive TSP emissions during the processing stage. During the combustion stage, a baghouse is also used to collect TSP and Pb. SO₂ is controlled by the use of limestone injection into the two (2) boilers and the use of coal fuel with a maximum sulfur content of 1.5% by weight. NO_x is controlled by the use of a selective non-catalytic reduction system for the boilers. The TSP and PM₁₀ emissions from the cooling tower are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Chevron

Chevron operates a petroleum refinery which produces various types of petroleum products. Petroleum is imported by ship and stored in above ground tanks prior to processing. The petroleum is processed, or refined, to produce various petroleum products. The main emission units are storage tanks, furnaces, an incinerator, boilers, combustion turbines, cooling tower, and flares.

TSP, PM₁₀, SO₂, NO_x, CO, and VOC are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. TSP and PM₁₀ are mainly controlled by a cyclone and electrostatic precipitator (ESP) for the FCC stack. The cooling tower also emits TSP and PM₁₀ which are controlled by limiting the water flow rate and amount of total dissolved solids within the water. A caustic scrubber reduces SO₂ emissions during flaring events from shutdowns or upsets. NO_x is controlled by the use of low NO_x burners in the furnaces and water injection/low NO_x burners in the combustion turbines. CO and VOCs are controlled by the use of steam atomizers and excess oxygen which completes the combustion process before the exhaust is emitted through the exhaust stack. VOC is also controlled by the use of a flare, a Benzene Recovery Unit, and the employment of proper leak detection and maintenance procedures. During the storage of the petroleum products, VOC is controlled with the use of various equipment for petroleum storage tanks such as gaskets, seals, and floating roofs. Since calendar year 1998, secondary seals have been installed on all applicable hydrocarbon tanks to provide additional controls for VOC.

Hawaiian Electric Company

Hawaiian Electric Company (HECO) operates a power plant in Kahe Valley. Fuel oil is imported, then stored in above ground storage tanks at the facility. From the storage tanks, the fuel oil is fed to the six (6) boilers and two (2) diesel engine generators for combustion.

TSP, PM₁₀, SO₂, NO_x, CO, and VOC are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. TSP and PM₁₀ are mainly controlled by the consumption of fuel oil with a low ash content. Periodic soot removal of the exhaust stacks also help control TSP and PM₁₀ emissions to minimize short-term concentrations. SO₂ is controlled by the combustion of low sulfur fuel oil (< 0.5% sulfur by weight). Thermal NO_x is reduced by lowering the initial combustion temperature of the boiler units. The combustion temperature is lowered by the use of low NO_x burners, flue gas recirculation, tangential firing, and low excess oxygen. CO and VOCs are controlled by the use of steam atomizers and excess oxygen which completes the combustion process before the exhaust is emitted through the exhaust stack.

Honolulu Resource Recovery Venture

Honolulu Resource Recovery Venture operates a municipal waste disposal facility and generates electricity for self operation and sale to Hawaiian Electric Company. The company and facility are commonly referred to as "HPOWER" for Honolulu Program of Waste Energy Recovery. The municipal waste is received, sorted, chopped, then fed into two (2) municipal waste combustors (MWC). After combustion, the air emissions flow through a spray dryer absorber and electrostatic precipitator before it reaches the exhaust stack. The resultant ash is collected in hoppers and disposed of into the landfill. There is also a cooling tower which extracts heat from the combustion gases and emits particulates which are dissolved solids in the evaporated water.

TSP and PM₁₀, SO₂, NO_x, and CO are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. Fugitive TSP and PM₁₀ emissions are controlled by using enclosed trucks and enclosed structures during the transportation and processing of the municipal waste. Baghouses also collect fugitive TSP and PM₁₀ emissions during the processing stage. TSP, PM₁₀, and Pb from the combustion stage and Spray Dryer Absorber (SDA) are abated by the electrostatic precipitator (ESP). SO₂ and hydrogen chloride (HCl) are reduced by the use of the SDA. The SO₂ precipitates and is collected by the ESP. NO_x is controlled by good combustion techniques. The cooling tower TSP and PM₁₀ emissions are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Kalaeloa Partners

Kalaeloa Partners operates a cogeneration plant which generates electricity for its own use and for sale to Hawaiian Electric Company. This facility qualifies as a cogenerator since it also produces steam with the hot combustion gases. The steam is sold to Tesoro. Fuel oil is piped in from Tesoro and consumed by two combustion turbines. There is also a cooling tower which extracts heat from the combustion gases and emits particulates which are dissolved solids in the evaporated water.

TSP, PM₁₀, SO₂, and NO_x are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. SO₂ is controlled by the use of low sulfur fuel oil (< 0.5% sulfur by weight). NO_x is controlled by the use of steam injection which lowers the combustion temperature. The cooling tower TSP and PM₁₀ emissions are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Tesoro Hawaii Corporation

Tesoro operates a petroleum refinery producing various types of petroleum products. Petroleum is imported by ship and stored in above ground tanks prior to processing. The petroleum is processed, or refined to produce various petroleum products. The main emission units are storage tanks, furnaces, incinerators, boilers, a combustion turbine, cooling tower, and a flare.

TSP, particulate matter which are 10 microns or smaller (PM_{10}), SO_2 , NO_x , CO, and VOC are the primary air pollutants being emitted from this facility.

The following briefly describes the air pollution control methods being employed. TSP and PM_{10} are mainly controlled by the consumption of fuel oil with a low ash content. The cooling tower TSP and PM_{10} emissions are controlled by limiting the water flow rate and amount of total dissolved solids within the water. SO_2 is controlled by the use of low sulfur fuel oil ($< 0.5\%$ sulfur by weight) and process controls such as a sulfur recovery unit. The sulfur recovery unit removes the sulfur from the gas streams which is condensed and sold as a solid. NO_x is controlled by the use of low NO_x burners in the heaters and water injection in the combustion turbine. VOC is controlled by the use of a flare, a thermal oxidizer for wastewater treatment, and the employment of proper leak detection and maintenance procedures. During the storage of the petroleum products, VOC is controlled with the use of various equipment for petroleum storage tanks such as gaskets, seals, and floating roofs. Slotted guide poles with sleeves were installed in 28 storage tanks to reduce fugitive VOC emissions.

TABLE A
2007 Campbell Industrial Park and Kahe Valley Major Source Criteria Emissions (tons/year)

Facility	TSP	PM ₁₀	SO ₂	NO _x	CO	VOC	Pb
AES ¹	256	221	1,514	754	204	29	0
Chevron ²	113	113	1,064	584	135	1,225	0.20
HECO Kahe Plant	899	678	7,231	4,822	568	87	0.19
HPOWER ³	138	130	60	963	43	0.8	0.30
Kalaeloa Partners	521	501	3,032	3,174	33	5	0.10
Tesoro ²	80	74	679	1,090	352	408	0.02
TOTAL (tons/year)	2,007	1,717	13,580	11,387	1,335	1,755	0.81

Source: State Department of Health, Clean Air Branch October 2008. Based on Covered Source actual emissions as submitted by the respective sources.

TSP - Total Suspended Particulates
PM₁₀ - Particulate Matter with aerodynamic diameter less than or equal to 10 microns
SO₂ - Sulfur Dioxide
NO_x - Nitrogen Oxides
CO - Carbon Monoxide
VOC - Volatile Organic Compounds
Pb - Lead

Note:

1. The nitrogen and sulfur content in the coal supply will continue to vary year to year.
2. The emissions will vary year to year depending on the demand for fuel.
3. The emissions may differ year to year due to the inconsistency of fuel (municipal waste).

SECTION 2.

Ambient Air Quality at Campbell Industrial Park: 2003 - 2007

The State of Hawaii enjoys some of the best air quality in the nation. However, as in any metropolitan area, we still experience our share of air pollution. In order to maintain Hawaii's air quality, pollution sources are regulated through the promulgation of rules and the issuance of air permits which limits emissions. The ambient air is monitored throughout the State by analyzers and meteorological equipment installed at strategic locations.

Air pollution is generated by many different sources. "Stationary sources" include those of factories, power plants, and refineries. "Area sources" are smaller stationary sources from which emissions are not easily associated with a single piece of equipment or activity. "Mobile sources" include cars, buses, planes, trucks, and trains. "Natural sources" are events such as wildfires, windblown dust, and volcanic eruptions. To protect the air quality, the Clean Air Act was enacted to provide the principal framework for National, and State efforts against air pollution.

The Clean Air Act established the National Ambient Air Quality Standards (NAAQS). The NAAQS is a set of health-based limits below which no adverse impacts to humans or the environment are anticipated. Two levels of standards are set in the NAAQS. "Primary" standards are designed to establish limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. "Secondary" air quality standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The U.S. Environmental Protection Agency (EPA) has set national air quality standards for six principal pollutants referred to as "criteria" pollutants. These are sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), ozone (O₃), lead (Pb) and particulate matter. This last pollutant includes particulate matter with an aerodynamic diameter less than or equal to ten microns (PM₁₀) and two and a-half microns (PM_{2.5}).

Two other pollutants, not covered by the NAAQS, are mentioned in this report. Volatile Organic Compounds (VOC) are a precursor of O₃, and, consequently, of smog. Total Suspended Particulates (TSP) was replaced as a criteria pollutant by PM₁₀. Performance standards exist for VOCs and TSP within the Hawaii Administrative Rules and both pollutants are controlled by permit.

Hawaii's air quality meets or exceeds all of the federal standards for air pollution control. As an example, the State's Ambient Air Quality Standards for CO and NO₂ are more stringent than the NAAQS.

The Department of Health currently operates and maintains a network of nine National Air Monitoring Stations/State and Local Air Monitoring Stations (NAMS/SLAMS) on the island of Oahu. Of the nine stations, three are located in and around Campbell Industrial Park (CIP): Makaiwa, Kapolei and West Beach stations. Detailed descriptions of each monitoring station are provided below.

The ambient air quality trends are based on actual measurements of pollutant concentrations in the air. Air pollutant trends for the three stations during the most recent five years are graphically displayed while the tables summarize the highest concentrations and annual average concentrations. None of the air pollutants measured exceeded the national or state ambient air quality standards. The 1-hour and 8-hour CO, and 3-hour SO₂ trends are based on the annual average of the daily maximum concentrations in each calendar year. Annual trends are based on the average of all valid hourly measurements recorded in the year. Except for PM₁₀, the air quality trends for SO₂, NO₂, and CO in the CIP area have been relatively level and well below the national and state standards. The PM₁₀ values show greater variability but are still well below the standards.

DEFINITIONS

The “Maximum Concentration” is the highest value recorded in the year for the averaging period.

The “Average of the Daily Max. Conc.” is the annual arithmetic mean of all the daily maximum values recorded for the averaging period.

“98th percentile” for PM_{2.5} is the 24-hour average that is higher than 98 percent of all valid 24-hour values recorded in the year. This is the value that is compared to the ambient air quality standard.

“Possible Periods” is the total number of possible sampling periods in the year.

“Valid Periods” is the total number of valid sampling periods after data audits.

“Annual Average” is the arithmetic mean of all hours recorded in the year.

MONITORING STATIONS

Kapolei

This station is located at 2052 Lauwiliwili Street approximately 200 yards south of the Desalination facility and the Kapolei Fire Station.

The pollutants sampled at this station are carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), PM₁₀, and PM_{2.5}. Meteorological parameters measured are wind speed, wind direction and ambient temperature.

The PM_{2.5} monitor is a filter-based manual sampler which operates once every 3 days in accordance with federal regulations.

West Beach

This station is located within the Ko’Olina Golf Course, west of CIP. It was established in February 1991 and currently monitors for NO₂, SO₂, and PM₁₀. Sampling for CO was discontinued in February 2003 because values were consistently very low. Meteorological parameters measured are wind speed and wind direction.

The PM₁₀ monitor at this site is a filter-based manual sampler which operates once every 6 days, in accordance with federal regulations.

Makaiwa

This station is located at 92-670 Farrington Highway, across from the Honokai Hale subdivision. Established in July 1989, this station monitors for SO₂. Meteorological parameters measured are wind speed and wind direction.

NOTE: Beginning with the 2007 report, all gaseous pollutants (CO, SO₂, and NO₂) will be reported in parts per million (ppm) to be consistent with federal reporting units.

2007 Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Possible Periods Valid Periods State/Federal Standard	3.8 0.3 8760 8563 9 / 35	- - - - -	- - - - -
8-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Possible Periods Valid Periods State/Federal Standard	0.8 0.3 8760 8614 4.4 / 9	- - - - -	- - - - -
3-hour Sulfur Dioxide (ppm) Maximum Concentration Average of Daily Max. Conc. Possible Periods Valid Periods State/Federal Standard	0.01 0.002 2920 2487 0.5 / 0.5	0.006 0.001 2920 2408 0.5 / 0.5	0.031 0.003 2920 2856 0.5 / 0.5
24-hour Sulfur Dioxide (ppm) Maximum Concentration Average of 24-hour Concentrations Possible Periods Valid Periods State/Federal Standard	0.003 0.002 365 360 0.14 / 0.14	0.002 0.001 365 343 0.14 / 0.14	0.009 0.002 365 360 0.14 / 0.14
Ann. Ave. Sulfur Dioxide (ppm) Annual Average Possible Periods Valid Periods State/Federal Standard	0.002 8760 8248 0.03 / 0.03	0.001 8760 7977 0.03 / 0.03	0.002 8760 8636 0.03 / 0.03
Ann. Ave. Nitrogen Dioxide (ppm) Annual Average Possible Periods Valid Periods State/Federal Standard	0.005 8760 8486 0.04 / 0.053	0.003 8760 8373 0.04 / 0.053	- - - -
24-hour PM ₁₀ (µg/m ³) Maximum Concentration Average of 24-hour Concentrations Possible Periods Valid Periods State/Federal Standard	75 ¹ / 57 17 365 350 150 / 150	28 13 61 57 150 / 150	- - - - -
Ann. Ave. PM ₁₀ (µg/m ³) Annual Average Possible Periods Valid Periods State Standard	17 365 350 50	13 61 57 50	- - - -
24-hour PM _{2.5} (µg/m ³) Maximum Concentration 98 th Percentile Average of 24-hour Concentrations Possible Periods Valid Period Federal Standard	20 8 4 122 111 35	- - - - -	- - - - -
Ann. Ave. PM _{2.5} (µg/m ³) Annual Average Possible Periods Valid Periods Federal Standard	4 122 111 15	- - - -	- - - -

¹ This is attributed to New Year's fireworks. The second number is the next highest value recorded in the year.

2006	Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide (µg/m³)				
Maximum Concentration		1596	-	-
Average of Daily Max. Conc.		224	-	-
Possible Periods		8760	-	-
Valid Periods		8615	-	-
State/Federal Standard		10,000/40,000		
8-hour Carbon Monoxide (µg/m³)				
Maximum Concentration		1183	-	-
Average of Daily Max. Conc.		148	-	-
Possible Periods		8760	-	-
Valid Periods		8627	-	-
State/Federal Standard		5,000/10,000		
3-hour Sulfur Dioxide (µg/m³)				
Maximum Concentration		12	24	62
Average of Daily Max. Conc.		5	4	8
Possible Periods		2920	2920	2920
Valid Periods		2526	2382	2868
State/Federal Standard		1,300/1,300	1,300/1,300	1,300/1,300
24-hour Sulfur Dioxide (µg/m³)				
Maximum Concentration		8	7	17
Average of 24-hour Concentrations		5	2	4
Possible Periods		365	365	365
Valid Periods		363	350	362
State/Federal Standard		365/365	365/365	365/365
Ann. Ave. Sulfur Dioxide (µg/m³)				
Annual Average		5	2	4
Possible Periods		8760	8760	8760
Valid Periods		8342	7945	8664
State/Federal Standard		80/80	80/80	80/80
Ann. Ave. Nitrogen Dioxide (µg/m³)				
Annual Average		9	6	-
Possible Periods		8760	8760	-
Valid Periods		8663	7419	-
State/Federal Standard		70/100	70/100	
24-hour PM ₁₀ (µg/m³)				
Maximum Concentration		59	33* / 22	-
Average of 24-hour Concentrations		16	12	-
Possible Periods		365	61	-
Valid Periods		355	57	-
State/Federal Standard		150/150	150/150	
Ann. Ave. PM ₁₀ (µg/m³)				
Annual Average		16	12	-
Possible Periods		365	61	-
Valid Periods ⁴		355	57	-
State/Federal Standard		50/50**	50/50	
24-hour PM _{2.5} (µg/m³)				
Maximum Concentration		34* / 9	-	-
98 th Percentile		7	-	-
Average of 24-hour Concentrations		4	-	-
Possible Periods		122	-	-
Valid Period		116		
Federal Standard		65***		
Ann. Ave. PM _{2.5} (µg/m³)				
Annual Average		4	-	-
Possible Periods		122	-	-
Valid Periods		116	-	-
Federal Standard		15		

* This is attributed to New Year's fireworks. The second number is the next highest value recorded in the year.

** The federal annual PM₁₀ standard was revoked by EPA on 12/17/06

*** The 24-hour PM_{2.5} standard was revised to 35 $\mu\text{g}/\text{m}^3$ on December 17, 2006.

2005 Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	1710	-	-
Average of Daily Max. Conc.	561	-	-
Possible Periods	8760	-	-
Valid Periods	8556	-	-
State/Federal Standard	10,000/40,000		
8-hour Carbon Monoxide ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	1055	-	-
Average of Daily Max. Conc.	453	-	-
Possible Periods	8760	-	-
Valid Periods	8551	-	-
State/Federal Standard	5,000/10,000		
3-hour Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	64	40	70
Average of Daily Max. Conc.	4	3	9
Possible Periods	2920	2920	2920
Valid Periods	2396	2521	2829
State/Federal Standard	1,300/1,300	1,300/1,300	1,300/1,300
24-hour Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	21	11	19
Average of 24-hour Concentrations	2	2	4
Possible Periods	365	365	365
Valid Periods	333	362	359
State/Federal Standard	365/365	365/365	365/365
Ann. Ave. Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)			
Annual Average	2	2	4
Possible Periods	8760	8760	8760
Valid Periods	7809	8320	8606
State/Federal Standard	80/80	80/80	80/80
Ann. Ave. Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$)			
Annual Average	9	6	-
Possible Periods	8760	8760	-
Valid Periods	8660	8087	-
State/Federal Standard	70/100	70/100	
24-hour PM ₁₀ ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	53* / 36	33	-
Average of 24-hour Concentrations	14	12	-
Possible Periods	365	61	-
Valid Periods	352	60	-
State/Federal Standard	150/150	150/150	
Ann. Ave. PM ₁₀ ($\mu\text{g}/\text{m}^3$)			
Annual Average	14	12	-
Possible Periods	365	61	-
Valid Periods ⁴	352	60	-
State/Federal Standard	50/50	50/50	
24-hour PM _{2.5} ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	55* / 11	-	-
Average of 24-hour Concentrations	4	-	-
Possible Periods	122	-	-
Valid Period	108	-	-
Federal Standard	65		
Ann. Ave. PM _{2.5} ($\mu\text{g}/\text{m}^3$)			
Annual Average	4	-	-
Possible Periods	122	-	-
Valid Periods	108	-	-
Federal Standard	15		

* This is attributed to New Year's fireworks. The second number is the next highest value recorded in the year.

2004 Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	2394	-	-
Average of Daily Max. Conc.	569	-	-
Possible Periods	8786	-	-
Valid Periods	8507	-	-
State/Federal Standard	10,000/40,000		
8-hour Carbon Monoxide ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	983	-	-
Average of Daily Max. Conc.	459	-	-
Possible Periods	8786	-	-
Valid Periods	8484	-	-
State/Federal Standard	5,000/10,000		
3-hour Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	17	10	46
Average of Daily Max. Conc.	2	1	7
Possible Periods	2928	2928	2928
Valid Periods	2504	2467	2827
State/Federal Standard	1,300/1,300	1,300/1,300	1,300/1,300
24-hour Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	7	4	15
Average of 24-hour Concentrations	1	<1	3
Possible Periods	366	366	366
Valid Periods	355	356	356
State/Federal Standard	365/365	365/365	365/365
Ann. Ave. Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)			
Annual Average	1	<1	3
Possible Periods	8786	8786	8786
Valid Periods	8214	8245	8565
State/Federal Standard	80/80	80/80	80/80
Ann. Ave. Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$)			
Annual Average	9	6	-
Possible Periods	8786	8786	-
Valid Periods	7880	8580	-
State/Federal Standard	70/100	70/100	
24-hour PM ₁₀ ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	54* / 53	22	-
Average of 24-hour Concentrations	13	13	-
Possible Periods	366	61	-
Valid Periods	339	58	-
State/Federal Standard	150/150	150/150	
Ann. Ave. PM ₁₀ ($\mu\text{g}/\text{m}^3$)			
Annual Average	13	13	-
Possible Periods	366	61	-
Valid Periods ⁴	339	58	-
State/Federal Standard	50/50	50/50	
24-hour PM _{2.5} ($\mu\text{g}/\text{m}^3$)			
Maximum Concentration	20* / 7	-	-
Average of 24-hour Concentrations	3	-	-
Possible Periods	121	-	-
Valid Period	99	-	-
Federal Standard	65		
Ann. Ave. PM _{2.5} ($\mu\text{g}/\text{m}^3$)			
Annual Average	3	-	-
Possible Periods	121	-	-
Valid Periods	99	-	-
Federal Standard	15		

* This is attributed to New Year's fireworks. The second number is the next highest value recorded in the year.

2003	Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide (µg/m³)				
Maximum Concentration	2166	-	-	
Average of Daily Max. Conc.	579	-	-	
Possible Periods	8760	-	-	
Valid Periods	8559	-	-	
State/Federal Standards	10,000/40,000			
8-hour Carbon Monoxide (µg/m³)				
Maximum Concentration	841	-	-	
Average of Daily Max. Conc.	460	-	-	
Possible Periods	8760	-	-	
Valid Periods	8559	-	-	
State/Federal Standards	5,000/10,000			
3-hour Sulfur Dioxide (µg/m³)				
Maximum Concentration	26	16	91	
Average of Daily Max. Conc.	4	1	7	
Possible Periods	2920	2920	2920	
Valid Periods	2461	2499	2809	
State/Federal Standards	1,300/1,300	1,300/1,300	1,300/1,300	
24-hour Sulfur Dioxide (µg/m³)				
Maximum Concentration	9	4	18	
Average of 24-hour Concentrations	1	<1	3	
Possible Periods	365	365	365	
Valid Periods	351	364	356	
State/Federal Standards	365/365	365/365	365/365	
Ann. Ave. Sulfur Dioxide (µg/m³)				
Annual Average	1	<1	3	
Possible Periods	8760	8760	8760	
Valid Periods	8168	8333	8511	
State/Federal Standards	80/80	80/80	80/80	
Ann. Ave. Nitrogen Dioxide (µg/m³)				
Annual Average	9	8	-	
Possible Periods	8760	8760	-	
Valid Periods	8120	8389	-	
State/Federal Standards	70/100	70/100		
24-hour PM ₁₀ (µg/m³)				
Maximum Concentration	99* / 72	33	-	
Average of 24-hour Concentrations	14	16	-	
Possible Periods	365	61	-	
Valid Periods	344 / 343	57	-	
State/Federal Standards	150/150	150/150		
Ann. Ave. PM ₁₀ (µg/m³)				
Annual Average	14	16	-	
Possible Periods	365	61	-	
Valid Periods	343	57	-	
State/Federal Standards	50/50	50/50		
24-hour PM _{2.5} (µg/m³)				
Maximum Concentration	11	-	-	
Average of 24-hour Concentrations	4	-	-	
Possible Periods	121	-	-	
Valid Period	113	-	-	
Federal Standard	65	-		
Ann. Ave. PM _{2.5} (µg/m³)				
Annual Average	4	-	-	
Possible Periods	121	-	-	
Valid Periods	113	-	-	
Federal Standard	15			

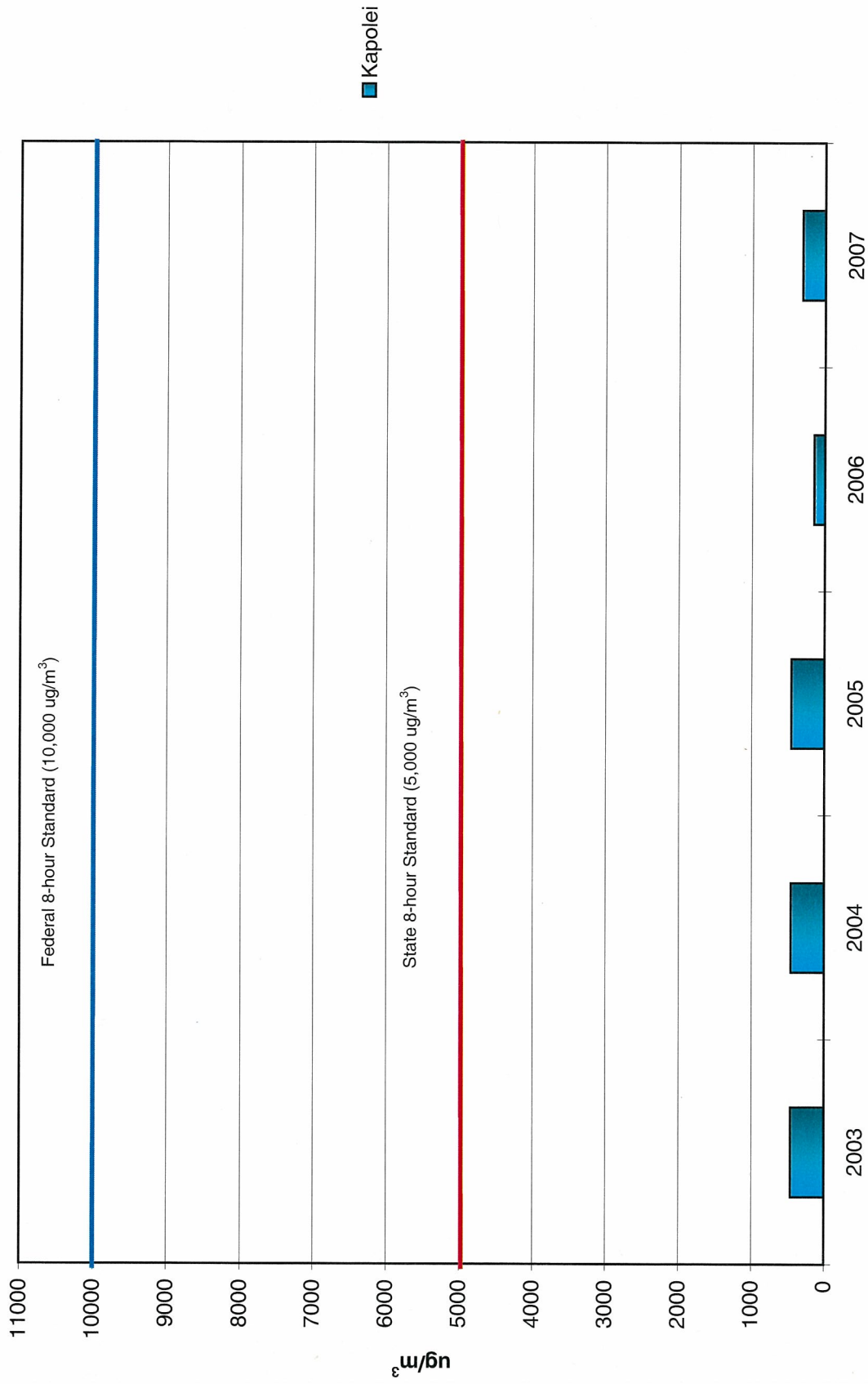
* This is attributed to New Year's fireworks. The second number is the next highest value recorded in the year.

**Figure 1. Annual Average of Maximum 1-hour
Carbon Monoxide¹ : 2003 - 2007**



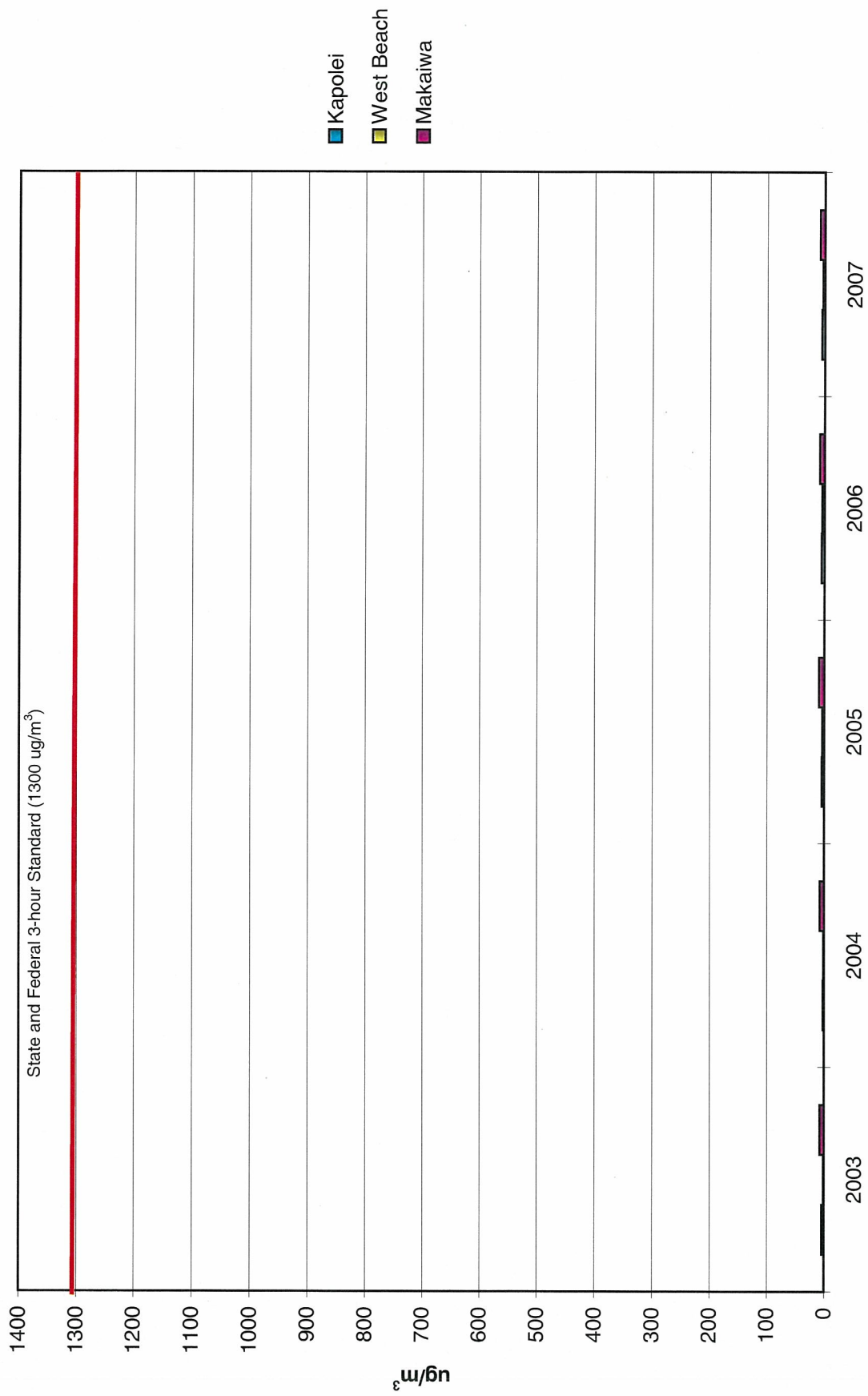
¹ Average of daily maximum 1-hour values in the year
NOTE: Monitoring for CO at West Beach was discontinued in February 2003

Figure 2. Annual Average of Maximum 8-hour Carbon Monoxide¹: 2003 - 2007



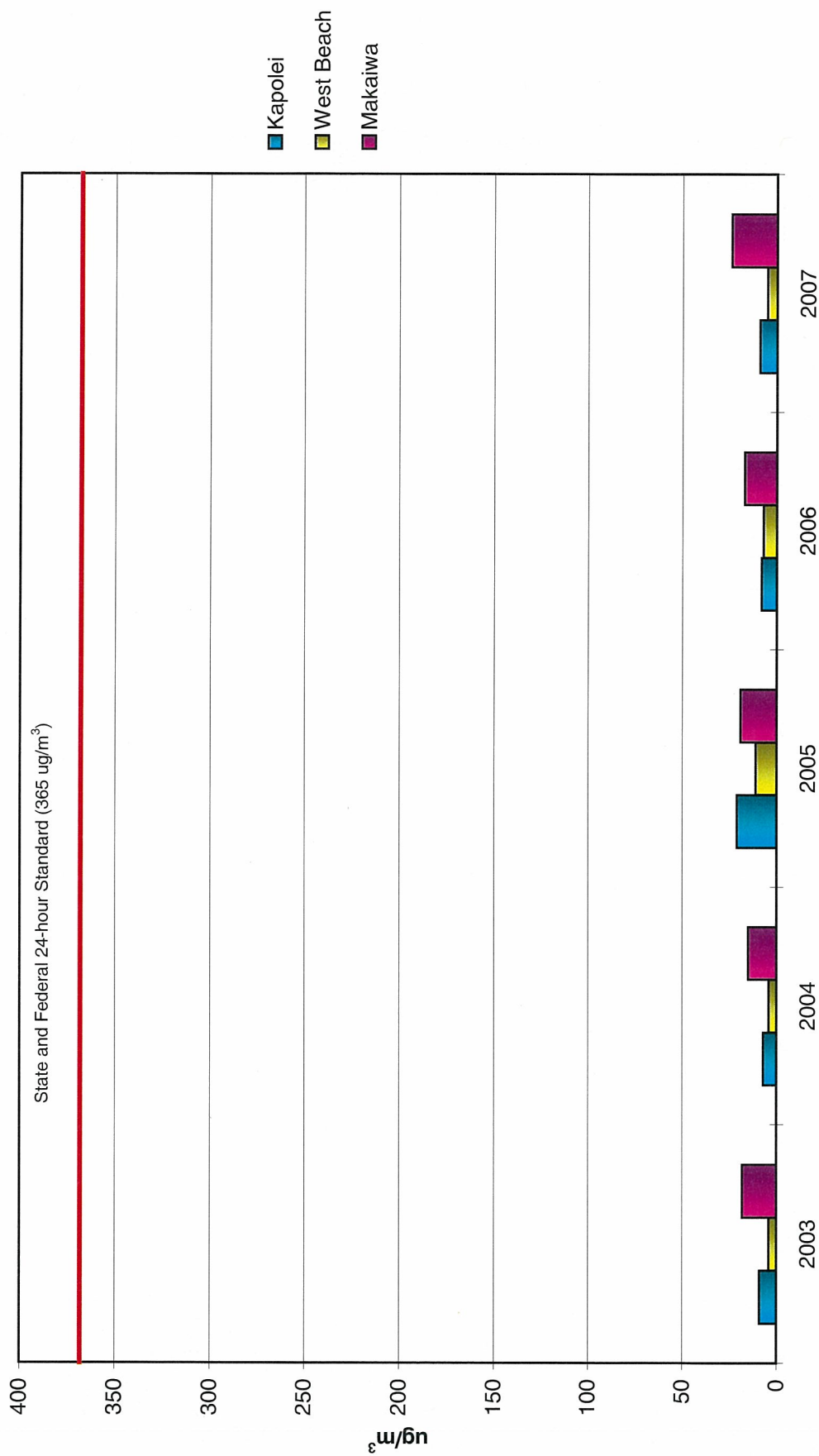
¹ The average of daily maximum 8-hour values in the year
 NOTE: Monitoring for CO at West Beach was discontinued in February 2003.

**Figure 3. Annual Average of Maximum 3-Hour SO_2 ¹
2003 - 2007**



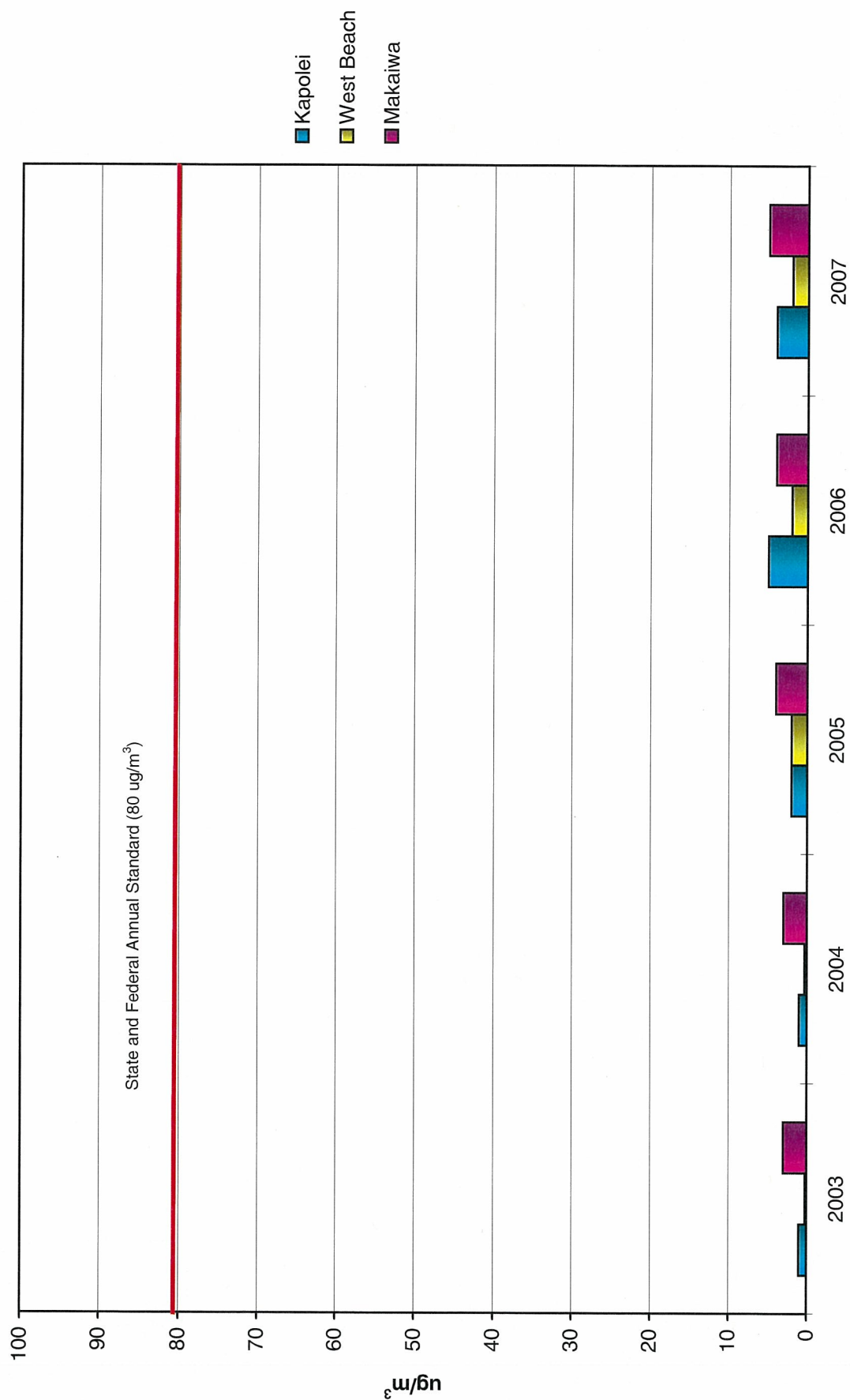
¹ The average of daily maximum 3-hour values in the year

**Figure 4. Maximum 24-hour Sulfur Dioxide ¹
2003 - 2007**



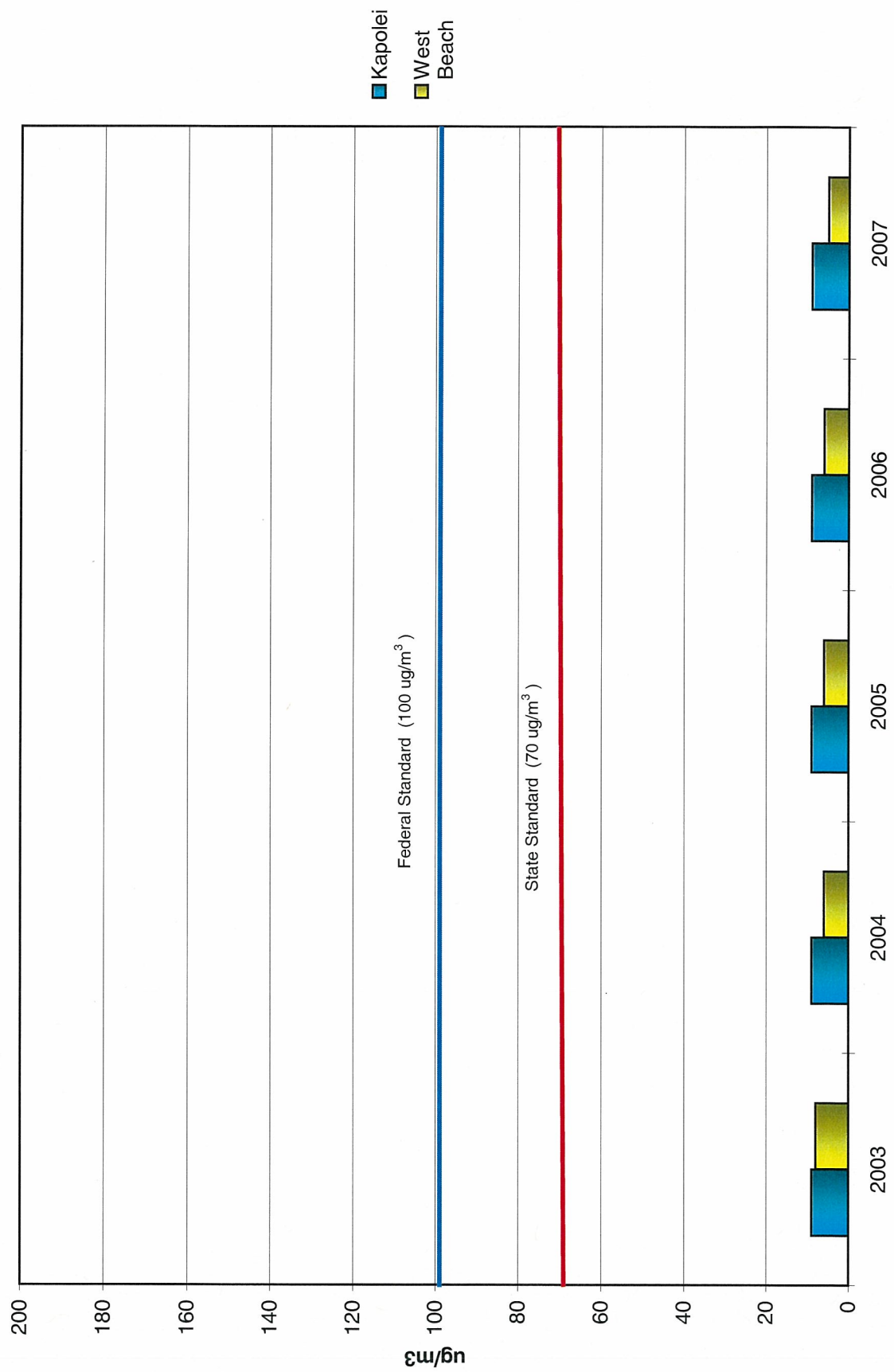
¹ The highest 24-hour value recorded in the year

**Figure 5. Annual Average of Sulfur Dioxide¹
2003 - 2007**



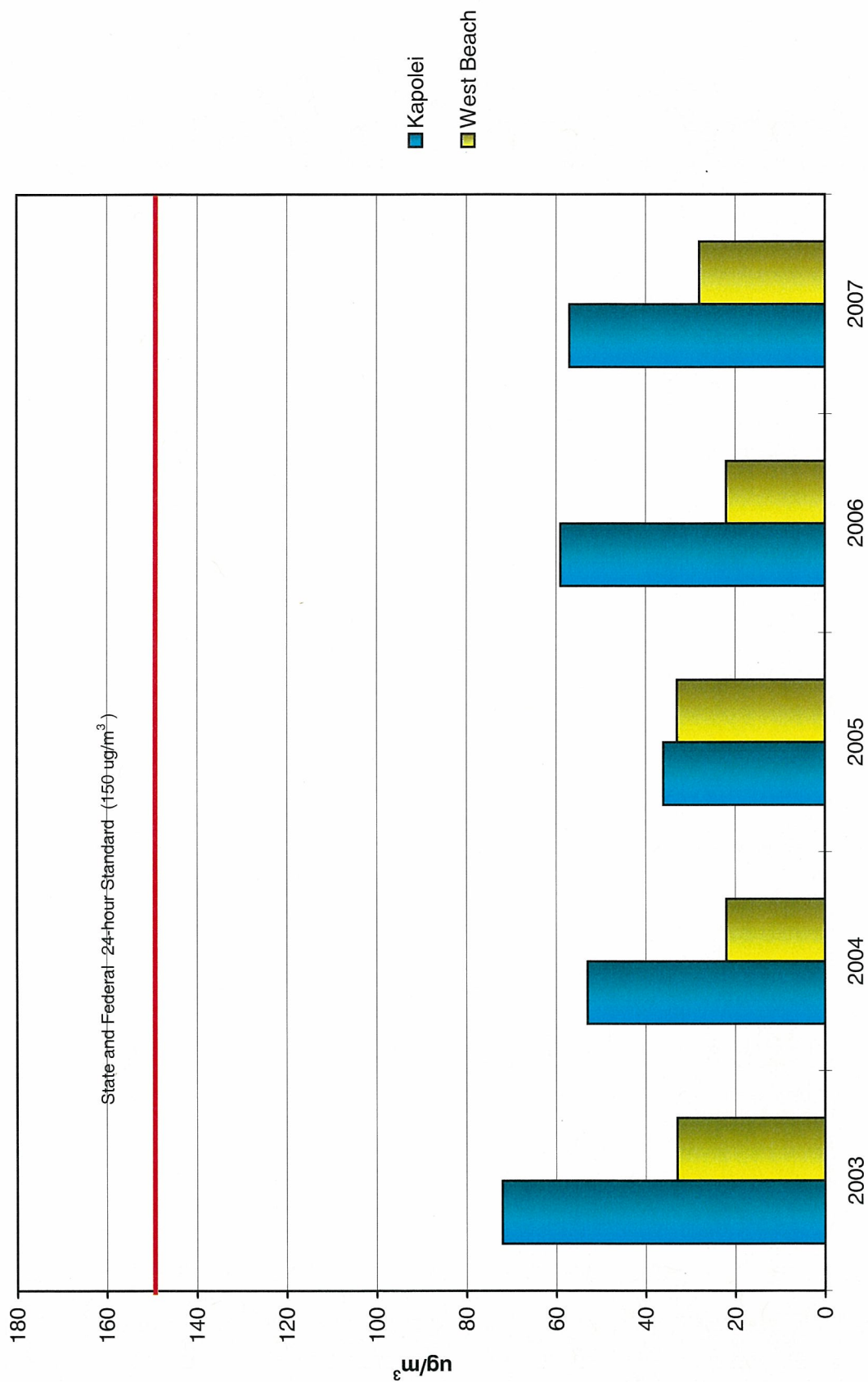
¹ The average of all valid hours recorded in the year

**Figure 6. Annual Average of Nitrogen Dioxide
2003 - 2007**



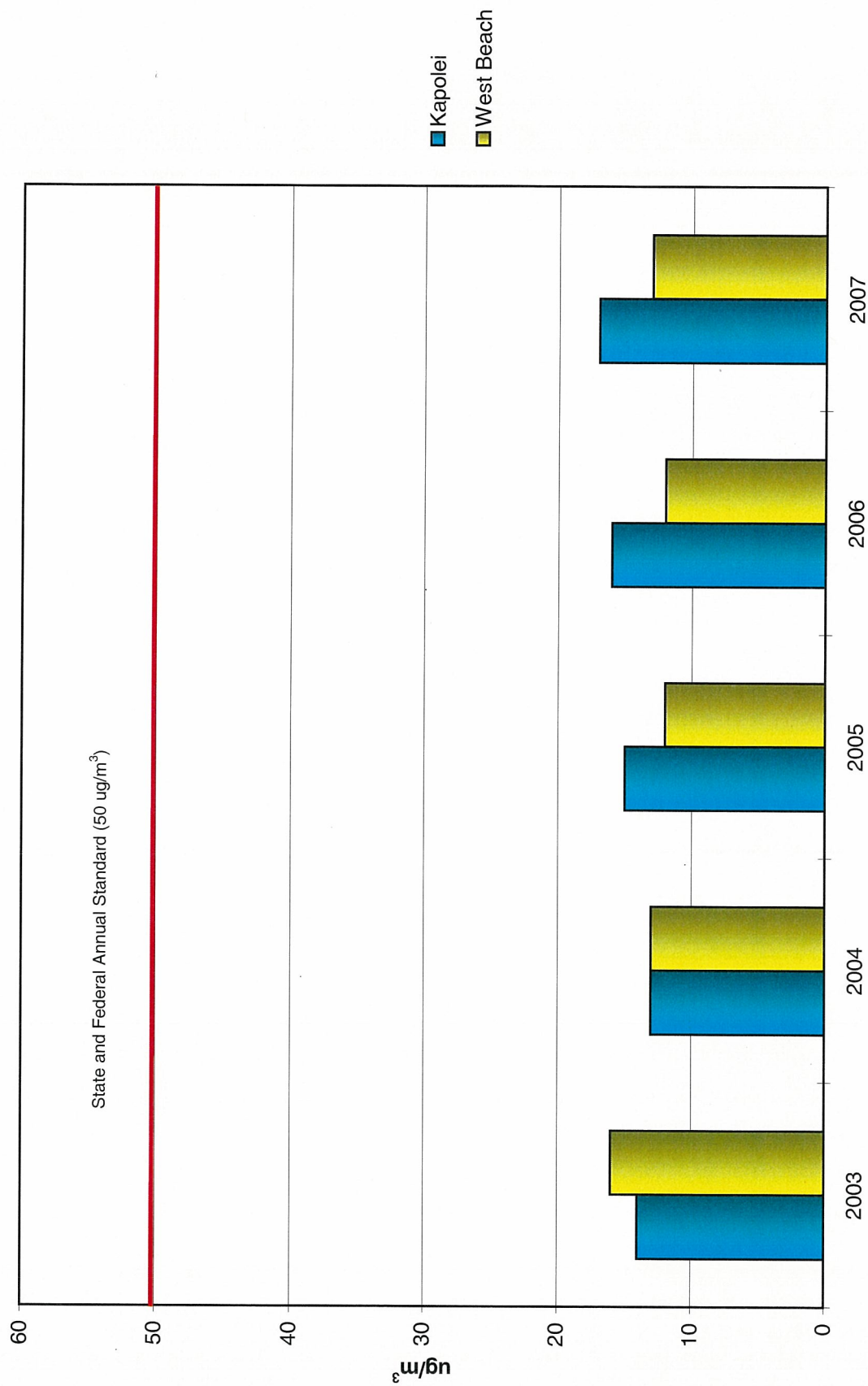
¹ The average of all valid hours recorded in the year

Figure 7. Maximum 24-hour PM_{10}^1 : 2003 - 2007



¹ The highest 24-hour value in the year excluding data due to fireworks

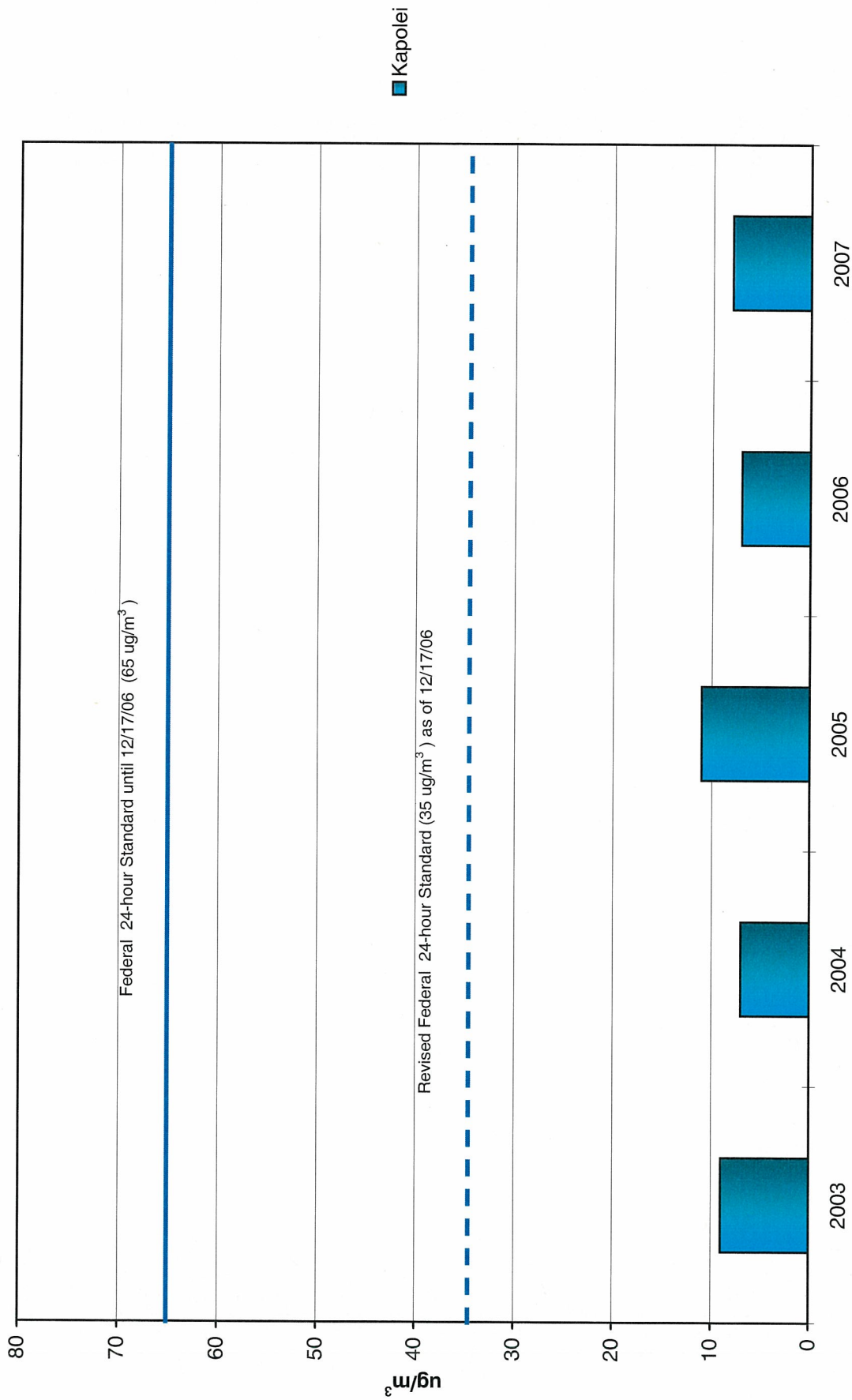
Figure 8. Annual Average of PM_{10}^1 : 2003 - 2007



¹ The average of all valid 24-hour values recorded in the year. This standard was revoked by the EPA on 12/17/06

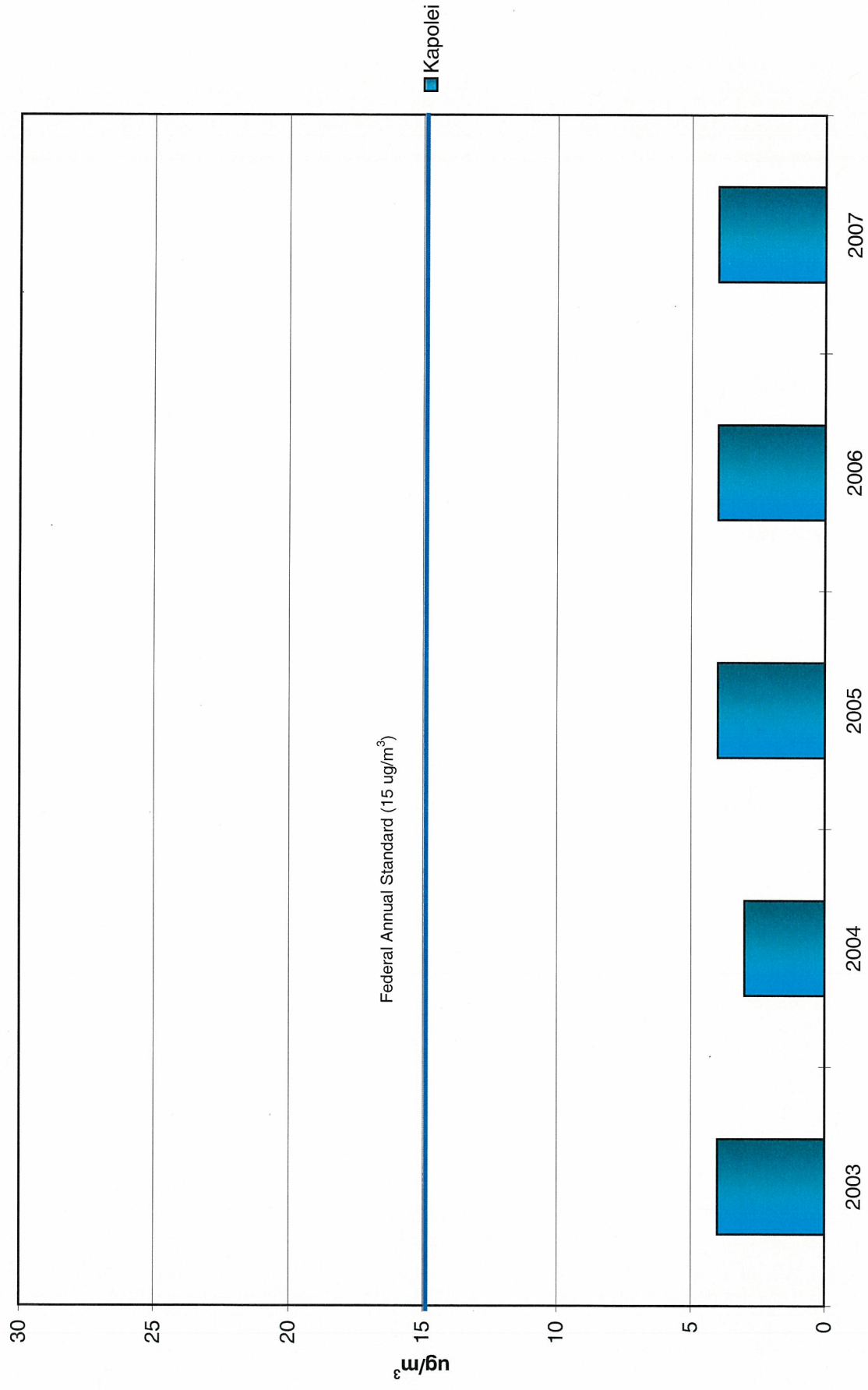
Note: West Beach has a manual sampler operated once every 6 days.

**Figure 9. 98th Percentile 24-hour $PM_{2.5}$ ¹
2003 - 2007**



¹ 98th percentile value is the 24-hour average that is higher than 98 percent of all valid values in the year. To attain the standard, the 98th percentile value must not exceed the level of the standard.

Figure 10. Annual Average of $PM_{2.5}$ ¹: 2003 - 2007



¹ The average of all valid 24-hour values recorded in the year.

SECTION 3.

Measurements of Selected Criteria and Non-criteria Pollutants in the Campbell Industrial Park Area and the Health Effects Expected at These Levels of Exposure

HEER Office, November, 2008

Criteria Pollutants

The United States government through the Environmental Protection Agency (EPA) and the Agency for Toxic Substances and Disease Registry (ATSDR) has established National Ambient Air Quality Standards (NAAQS) for six "criteria air pollutants" to be used as guidelines of exposure to protect human health from the possible effects of air pollutants. These standards are based on scientific studies in both epidemiology and controlled laboratory experiments often using human volunteer subjects. The six Criteria Air Pollutants include: ozone (O₃), airborne lead (Pb), particulate matter 10 micrometers and less in size (PM₁₀), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂). These pollutants were selected based on multiple criteria including their toxicity and their relative abundance and distribution in industrialized society.

The Clean Air Branch in the Department of Health has collected data for PM₁₀, CO, NO₂ at two locations in Campbell industrial Park (CIP), namely Kapolei and West Beach, and SO₂ at three locations in CIP (Kapolei, West Beach and Makaiwa). PM_{2.5} data were collected at the Kapolei location. These data are summarized for the years 2003 -2007 in Section 2 of this report.

The levels of these four criteria air pollutants measured in the CIP area are consistently below the National Ambient Air Quality Standards and Hawaii State Ambient Air Quality Standards.

Possible Health Effects of Criteria Air Pollutants at CIP

The following is an overview of some of the possible health effects of the four criteria air pollutants measured at CIP. This is *not* intended to be a complete or thorough description of the toxicology of these pollutants. Rather, this note aims to give some idea of the effects these pollutants can have *at high enough concentrations*. First, it is important to understand the first rule of toxicology: that taking a sufficient amount of any material into the body can produce toxic effects. The rate of intake can also influence toxic effects. Humans, on average over a day or more, typically breathe about 20 cubic meters of air per day. Because of this and available scientific data, we can get a fairly good idea of what concentrations of air pollutants are needed before adverse health effects are seen. Even so, there are no clear cut numbers below which, there is no risk and above which we are all at risk. Safety factors are then used to help compensate for uncertainties and to provide added protection for the more sensitive people in the population.

In the following paragraphs, the levels of pollutants measured in the CIP area in 2006 are compared to the NAAQS and the expected health effects for those levels of exposure are discussed as well as the effects that would be expected at much higher levels of exposure.

Sulfur dioxide (SO₂): The NAAQS levels for sulfur dioxide are set at 0.500 ppm for a three hour averaging period, 0.140 ppm for a 24-hour averaging period, and 0.030 ppm for a one year averaging period. In 2007, the annual averages were less than 0.002 ppm, well below the NAAQS of 0.030 ppm. The maximum concentrations measured for the 3-hour and 24-hour averaging times were below their respective NAAQS. The maximum 24-hour concentration measured was 0.009 ppm, while the maximum 3-hour concentration was 0.031 ppm.

Nitrogen dioxide (NO₂): The NAAQS level for nitrogen dioxide has been set at 0.053 ppm for a one year averaging period, and Hawaii has set that level at 0.040 ppm for added safety. The maximum annual average concentration measured in 2007 was 0.005 ppm, well below the Federal and State standard.

Sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) are gases that, combined with water on the wet surfaces of the body, produce acids. *At high enough levels*, these acid gases are irritating to the lungs, eyes, nose and throat, and can cause shortness of breath. Levels found in the CIP area typically average less than 0.010 ppm. These levels of exposure are not expected to produce adverse health effects. For irritants such as the acid gases SO₂ and NO₂, sensitive individuals may have short-lived responses to brief peaks in concentration which would not appear in these averaged data. Such short-term peaks are more apparent in the maximum readings found in shorter term (1-3 hour) averaging times.

Carbon monoxide (CO): The NAAQS levels for carbon monoxide have been set at 35 ppm for a 1-hour averaging period, and 9 ppm for an 8-hour averaging period¹. Hawaii has set those levels at 9 and 4.4 ppm respectively for added safety. In 2007, the 1-hour and 8-hour average CO levels measured in the CIP area were 0.3 ppm. These average levels of exposure are not expected to produce adverse health effects. In 2007, the maximum 1-hour concentration for carbon monoxide was 3.8 ppm. The maximum 8-hour concentration for carbon monoxide was 0.8 ppm.

¹

Values are rounded to the nearest whole number.

Carbon monoxide (CO) is an odorless colorless gas that interferes with the ability of blood to carry oxygen. Symptoms of overexposure include headache, shortness of breath, dizziness at about 50-100+ ppm; severe headache, weakness, dizziness, nausea / vomiting fainting, rapid breathing at 400-500+ ppm; fainting, seizure, coma, respiratory failure, death at 1000-4000+ ppm. The highest one hour average level measured in the CIP area was 3.8 ppm.

Particulate Matter 10 micrometers and less in size (PM₁₀): The NAAQS levels for PM₁₀ have been set at 150 µg/m³ averaged over 24 hours and 50 µg/m³ averaged over one year. In response to new scientific data, the EPA revised the particulate matter standard in July, 1997 to include a standard for “fine particle” which are equal to or less than 2.5 micrometers in size (PM_{2.5}). These PM_{2.5} standards were set at 65 µg/m³ averaged over 24 hours and 15 µg/m³ averaged over one year. On December 17, 2006 the 24-hour standard for PM_{2.5} was lowered to 35 µg/m³ to better protect the public from short-term fine particle exposure. Adverse health effects of particulate matter can include impaired lung function, a reduction in capacity for physical activity, complication of heart disease and increased population death rates. The levels of exposure producing adverse effects are even less clear cut than they are for the gases discussed above. Based on laboratory results and extensive epidemiology studies, the EPA has set the fine particulate standards to provide an increased measure of protection from adverse health effects due to particulate matter.

The 24-hour averages and the annual averages for PM₁₀ were 17 µg/m³ for Kapolei and 13 µg/m³ for West Beach. In 2007, the maximum 24-hour concentration was 75 µg/m³ for Kapolei. The maximum 24-hour concentration for West Beach was 28 µg/m³. Although the adverse health effects from these levels of exposure are currently controversial, these averages are similar to Honolulu which has one of the lowest urban PM₁₀ levels in the United States. The 24-hour average and the annual average for PM_{2.5} were 4 µg/m³ for the one monitoring site in Kapolei, well below the Federal standard. In 2007, the maximum 24-hour concentration was 20 µg/m³ for Kapolei.